U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

AC 120-70
DATE: 2/17/00

INITIAL AIR CARRIER OPERATIONAL APPROVAL FOR USE OF DIGITAL COMMUNICATION SYSTEMS

For sale by the Superintendent of Documents, U.S. Government Printing Office,
Washington D.C. 20402

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1. PURPOSE. This advisory circular (AC) provides an acceptable means, but not the only means, for operational approval to use digital communications systems, including data link and voice communication (e.g., via satellite), for air traffic service (ATS) and related capabilities for operators conducting operations under Title 14 of the Code of Federal Regulations (14 CFR), parts 121, 125, 129, and 135.

2. CANCELLATION. [Reserved.]

3. APPLICABILITY. This AC applies to aircraft and air carriers operating under parts 121, and 135, other organizations conducting training approved in accordance with part 121 (e.g., training centers or aircraft manufacturers), operators under part 125, and foreign air carriers conducting operations in U.S. airspace under part 129. This AC describes the digital communications operational approval process, acceptable methods for training, acceptable programs for maintenance, operational policies for use, appropriate actions in the event of an exceptional air traffic control (ATC) digital communications event, and criteria for foreign operator use of digital communications in U.S. airspace. This AC may also be applied to those operators and aircraft operating under 14 CFR part 91.

a. This AC does not address the use of digital communications for specific ATS applications (e.g., ATIS, PDC, and DDTC) which are information services not directly related to aircraft separation.

b. This AC addresses satellite voice services to the extent that they may be used for distress, emergency and non-routine communications, or other means of communications that may meet the requirements of part 121, section 121.99.

4. RELATED MATERIAL.

a. Title 14 Code of Federal Regulations (14 CFR). The following 14 CFR parts are applicable to communications systems and applications covered in this document: parts 21, 23, 25, 27, 29, 43, 91, 121, and 135.

b. Advisory Circulars. The following AC may provide additional information to assist in the operational approval of digital communications systems:

- AC 20-140, Guidelines for Design Approval of Aircraft Data Communications Systems.

c. The following International Civil Aviation Organization (ICAO) documents:

(1) Annex 10 to the ICAO Convention (Standards and Recommended Practices – SARP's), Volume III, Part 1, Digital Data Communications Systems

(2) Document 4444 (PANS/RAC), Procedures for Air Navigation Services - Rules of the Air and Air Traffic Services

(3) Document 7030, Regional Supplementary Procedures

d. Copies of the following RTCA documents may be purchased from RTCA Inc., 1140 Connecticut Avenue, NW., Suite 1020, Washington, DC 20036:

(1) DO-210C, Minimum Operational Performance Standards for Aeronautical Mobile Satellite Service (AMSS avionics)

(2) DO-212, Minimum Operational Performance Standards for Airborne Automatic Dependent Surveillance (ADS) Equipment

(3) DO-215A, Guidance on Aeronautical Mobile Satellite Service (AMSS) End-to-End System Performance

(4) DO-219, Minimum Operational Performance Standards for ATC Two-Way Data Link Communications (Applications)

(5) DO-222, Guidelines on AMS(R)S Near-Term Voice Implementation and Utilization

(6) DO-224, Signal-in-Space Minimum Aviation System Performance Standards for Advanced VHF Digital Communications Including Compatibility with Digital Voice Techniques

(7) DO-231, Design Guidelines and Recommended Standards for the Internetworking, Implementation and Use of AMS(R)S Voice in a Data Link Environment)

(8) DO-239, Minimum Operational Performance Standards for Traffic Information Services (TIS) Data Link Communications

(9) DO-240, Minimum Operating Performance Standards for Aeronautical Telecommunication Network (ATN) Avionics

(10) DO-242, Minimum Aviation System Performance Standards for Automatic Dependent Surveillance Broadcast (ADS-B)

(11) DO-243, Guidance for Initial Implementation of Cockpit Display of Traffic Information

e. Copies of the following SAE documents may be purchased from SAE International, Customer Sales, 400 Commonwealth Avenue, Warrendale, PA, 15096:

(1) ARP 4754, Certification Considerations for Highly-Integrated or Complex Aircraft Systems

(2) ARP 4761, Guidelines and Methods for Conducting the Safety Assessment Process on Civil Airborne Systems and Equipment

5. HOW TO ORDER.

a. Copies of this AC and other AC's mentioned herein may be obtained from:

U.S. Department of Transportation
Subsequent Distribution Office, SVC-121.23
Ardmore East Business Center
3341 Q 75th Ave.
Landover, MD 20785

b. Identify this publication in your order as Federal Aviation Administration (FAA) Advisory Circular (AC 120-70), Initial Air Carrier Operational Approval For Use Of Digital Communication Systems.

6. BACKGROUND AND DEFINITIONS.

a. Data Link Implementation. Data link applications are being implemented in part 121 operations and other operations on a widespread basis (e.g., PDC, D-ATIS, FANS-1 CPDLC, FIS/TIS, and ADS). Data link *applications* operate without any specific knowledge by the user as to whether a satellite, VHF, or HF air/ground data link medium network service is in use. However, these applications may be limited by the level of end-to-end data link service implementation in use (e.g., ACARS, FANS-1 ACARS/ARINC 622, CNS/ATM-1). This AC provides information for U.S. air carriers, aircraft and data link manufacturers, various inspectors, foreign air carriers operating in U.S. airspace, and other aviation organizations regarding standard means acceptable to the FAA to establish and ensure continued compliance with FAA regulations related to the use of data link for ATS communications. This information is intended to facilitate the operational approval of data link systems, promote timely and comprehensive program implementation, encourage development of standard practices for the application of data link techniques, and provide for suitable follow up to exceptional data link events.

b. Satellite Voice Implementation. The satellite communications system (AMSS) is unique among the currently available air/ground data network services in that it has an inherent voice capability that can be used concurrently with the data service. The satellite voice capability, when implemented in an overall Concept of Operations that integrates voice and data link in a useful framework, will provide an important new capability in airspace where only HF radio third-party (non-direct) services (e.g., via ARINC radio operators) are currently available. FAA and other Civil Aviation Authority (CAA) have made some initial provisions for the use of satellite voice in limited situations subject to administration policy. In addition to operational approval of data link communications, this AC will define the procedures necessary to obtain operating approval for the use of satellite voice for ATS communications subject to route-specific limits that may be imposed.

c. Definitions. For convenience, some definitions in this AC are repeated from other pertinent FAA references. Other definitions are unique to this AC and their application is limited to use with data link and satellite voice communications.

(1) Aircraft Certification Office (ACO). FAA offices responsible for determination of aircraft airworthiness regarding issuance of Type Certificate (TC), Supplemental Type Certificate (STC), and other issues related to parts 21, 23, 25, 33, and other similar airworthiness rules. ACO's are also responsible for technical assessment of service difficulties including issuance of Airworthiness Directives (AD).

(2) Aircraft Evaluation Group (AEG). FAA offices responsible for operational aspects of newly certificated, modified, or "in-service" aircraft. AEG's establish FAA criteria for pilot qualification as it relates to Flight Standards Board (FSB) and initial aircraft certification, minimum equipment lists (MEL), initial airworthiness, and other such requirements as they relate to 14 CFR parts 43, 61, 91, 121, 135, and other operationally related regulations.

(3) Certificate-Holding District Office (CHDO). A Flight Standards office that is responsible for administration of a part 121 and a part 135 operating certificate for a particular operator.

(4) Communication Classification. Classes of data link installed communications performance (ICP) levels for which an aircraft is equipped, and for which end-through-end service provider levels are arranged, are as specified in paragraph 7c.(1).

(5) Data Link. A communications capability comprising air/ground and ground/ground data network services, specified data link message sets and protocols, aircraft equipment, ATS Facility equipment, and operational procedures intended to provide supplemental ATS communications without reversion to voice procedures under most circumstances.

(6) Data Link Event. (See also Exceptional Data Link Event paragraph 6c.(10).) For the purpose of this AC, a Data Link Event is one or more of the following occurrences or situations related to data link:

(a) Data link-related in-flight traffic conflicts or potential conflicts as determined by a flightcrew,

(b) Near mid-air collisions (NMAC) involving a data link-equipped aircraft,

(c) Data link system performance below that of normal operation,

(d) ATC system error involving a data link-equipped aircraft, or

(e) Other data link occurrences or situations related to potential data link or ATC system safety performance.

(7) Digital Communications Academic Training (as applied within this AC). Training that exclusively addresses *knowledge* requirements (rather than skills), and is usually related to achieving satisfactory knowledge of digital communications concepts, systems, limitations, or

procedures. Digital communications academic training generally is accomplished using a combination of classroom methods (stand up instruction, slide/tapes, computer-based instruction (CBI), tutorial, etc.), flight manual information, bulletins, or self-study. See paragraph 8b. for an expanded explanation of what should be taught.

(8) Digital Communications Use Training. Training which addresses skills related to digital communications operational use. Digital communications use training includes both knowledge and skills to receive a data link communication, appropriately accept, reject, defer a response to, or cancel a message, load, store, or otherwise act on a message, formulate and send a message, initiate a SATCOM voice call to the appropriate facility, and otherwise manage the communication system.

(9) Digital Communications. A general term referring to data link and digital voice communication (e.g., SATCOM voice), individually or in combination.

(10) Exceptional Data Link Events. (See also Data Link Event, para. 6c.(6).) Exceptional data link events are those which meet any one of the following guidelines:

(a) There is a loss of standard ATC separation resulting from a procedure or maneuver where a data link transaction, failure, or unmonitored error is suspected to be a factor;

(b) The performance of the data link system (e.g., message delivery delay) is suspected to be outside of required operating parameters;

(c) The function or performance of the data link system are thought to have an adverse impact on crew workload;

(d) A data link message is received containing apparently unreasonable information which was subsequently verified to be erroneous; or

(e) There is a data-link related excursion of more than 500 feet from an assigned flight level/altitude, or lateral or longitudinal deviation exceeding ATS minimum separation criteria.

(11) Flight Standards District Office (FSDO). An FAA field office serving an assigned geographical area and staffed with Flight Standards personnel who serve the aviation industry and the general public on matters relating to the certification and operation of air carrier and general aviation aircraft.

(12) Flight Standards Board (FSB). The FAA board responsible for establishing or revising crew qualification requirements (e.g., training, checking, currency, and type rating(s)) for specific aircraft. FSB's are established for each large turbojet, turboprop, and special 14 CFR part 41 airplane type used in air transportation, as well as other part 25 airplanes, transport category multi-engine helicopters, and large multi-engine piston airplanes.

(13) Follow-on STC (as related to digital communications). A digital communications STC other than as described in item (14) below for an "Initial TC/STC." The following examples are considered to be "follow-on" STC's:

(a) A previously approved digital communications installation which is installed in a subsequent type or model aircraft.

(b) Changes of display configuration (FMS/data link display), supporting system (EICAS/ECAM) or other aircraft interface (DFDR, etc.).

(14) Initial TC/STC (as related to digital communications). The first FAA digital communications airworthiness approval (in accordance with a TC or STC) of any one or combination of the following components: a data link processor and/or management unit, data link communications avionics, control and/or display unit associated with SATCOM voice.

NOTE: For previously approved digital communications systems, if the part number of any of the above components changes due to a significant modification, the system change may require an initial TC/STC.

(15) Installed Communications Performance (ICP). (See also Required Communications Performance (RCP), para.6c.(21).) Installed Communications Performance is a statement of the *nominal* performance of a given end-through-end communication link (i.e., data link or voice link) comprising the aircraft end system(s), avionics; aircraft radio(s); RF path(s); ground station(s), ground network(s) and the service arrangements and levels that have been arranged for with air/ground service providers; and the ground end system(s).

(16) Maintenance Review Board (MRB). An FAA board responsible for establishing maintenance requirements for a specific aircraft type. MRB requirements are usually formulated in conjunction with information provided by the manufacturer and prospective operators through industry working groups. FAA CHDO's apply MRB requirements in reviewing and approving each carrier's proposed maintenance program.

(17) Master Minimum Equipment List (MMEL). An FAA document listing stipulations in accordance with section 121.628 and section 135.179 that provides authorization for the continuation of flight beyond a terminal point with certain equipment inoperative. AEG's develop MMEL's in conjunction with a Flight Operation Evaluation Board (FOEB) established for each aircraft type. FAA MMEL's serve as the basis for an operator to develop specific minimum equipment lists (MEL's) applicable to its particular aircraft and operational requirements.

(18) National Airspace System (NAS). The common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations, and procedures; technical information, manpower, and material; and system components shared jointly with the military.

(19) National Simulator Evaluation Team (NSET). Team of FAA operations specialists responsible for evaluating flight simulators to aid principal operations inspectors (POI) in approving those simulators in accordance with Regulation requirements (e.g., NSET evaluations support POI approval of a particular simulator for use in a specific part 121 program).

(20) Principal Inspector (PI). Refers to one of three FAA principal inspectors: principal avionics inspector (PAI), principal operations inspector (POI), or principal maintenance inspector (PMI).

(a) Principal Avionics Inspector (PAI). The FAA inspector assigned responsibility for overseeing all avionics issues relative to a specific operator, to include input to training programs, operations specifications, MEL requests, etc.

(b) Principal Operations Inspector (POI). The FAA inspector assigned responsibility for overseeing all operational issues relative to a specific operator, including approval of training programs, operations specifications approval, maintenance programs, MEL change requests, etc.

(c) Principal Maintenance Inspector (PMI). The FAA inspector assigned responsibility for overseeing all maintenance issues relative to a specific operator, to include input to training programs approved maintenance programs, operations specifications, MEL requests, etc.

(21) Required Communications Performance (RCP). (See also Installed Communications Performance (ICP), para (15).) Required Communications Performance is a statement of the end-through-end communication performance necessary for flight within a defined airspace or to conduct a defined operation or procedure. RCP is determined by appropriate authorities in consideration of air traffic operations, target levels of safety, separation assurance, flight standards and functional hazard analysis associated with the airspace, operation, or procedure. Thus, RCP is independent of the technology, or combination of technologies, that may be utilized for communications.

(22) Supplemental Type Certificate (STC). An FAA certificate attesting to the fact that modifications to the respective aircraft, engines, or other components meet airworthiness requirements of the regulations.

(23) Type Certificate (TC). An FAA certificate attesting to the fact that the respective aircraft, engines, or other components meet airworthiness requirements of the regulations.

(24) Satellite Voice Service (SATCOM Voice, Initial). As it pertains to capabilities described in this document, an end-to-end satellite voice service based on the guidelines contained in RTCA document No. DO-222. Aircraft satellite voice installations having an airworthiness approval based on AC 20-140, may be approved for use in ATS communications, provided that: (1) such equipment is not required by an aircraft's operating approval, and (2) other means of ATS voice communication approved for use on the intended route of flight are available and operating (e.g., HF voice).

7. APPROVAL TO USE DIGITAL COMMUNICATIONS IN PART 121 OPERATIONS.

a. General.

(1) Use of digital communications in part 121 operations requires both FAA design approval and operational approval. Design approval of digital communications refers to an FAA approval of changes in an aircraft's type design by amendment to a TC or issuance of an STC. Operational approval pertains to changes to operations specifications (OpSpecs), authorizations, training and maintenance programs, manuals, operational procedures, MEL's, and other such areas necessary for safe and effective use of digital communications. Operational approval pertains also to an operator's use of a digital communication service offered by a digital communication service provider, or a SATCOM voice service offered by a SATCOM voice service provider, who demonstrates, for example, on an ongoing basis that the service provides the digital communication performance required on a specific route. A TC'd or STC'd digital communications system or SATCOM voice system alone does not constitute operational approval for use of digital communication under provisions of part 121.

(2) Responsibilities of various FAA Offices Regarding Digital Communications. FAA ACO's approve changes to a type design or issuance of STC's. FAA AEG's formulate operational criteria for specific aircraft types related to training, checking, maintenance, MMEL's or other operational issues, as necessary. FAA FSDO's use information developed by AEG's to review a particular operator's programs. FSDO's approve particular OpSpecs, letters of authorizations, operator's training and maintenance programs, operational procedures, MEL's, etc., if they are consistent with criteria specified in this AC; MMEL's, FSB, MRB reports and policy guidance from the Flight Standards Service (AFS), Continuous Airworthiness Maintenance Division, AFS-300, and Air Transportation Division, AFS-200.

b. Design Approval of Aircraft Data Communications Systems. Guidelines of design approval of aircraft data communication and SATCOM voice systems and applications primarily used for ATS are provided in FAA AC 20-140 or foreign equivalent.

c. Operational Approval.

(1) Criteria for Data Link Operational Authorization. Criteria for data link operational authorization are determined by the RCP specified for the intended operation when data link communications are used. Operators should not request authorization to conduct data link operations for systems that do not meet the design approval and functionality guidelines of AC 20-140 or equivalent.

(2) Criteria for Digital Voice Operational Authorization. Criteria for the authorized use of digital voice (SATCOM) are currently based on the fact that SATCOM voice is not a required capability in U.S. airspace; is not an approved primary or sole-means communications capability; and is not required for FANS-1 operations. As a consequence, ICP requirements have not yet been established. The FAA and many CAA's permit SATCOM voice use, provided that compliance with existing requirements for the carriage of voice radio systems is met. Operating

approvals for the use of SATCOM voice should take into consideration the specific installation requirements for the aircraft equipment and the specific aspects of the SATCOM voice services that have been obtained by the applicant. Useful guidelines that address operational procedures, security, and human factors issues pertaining to the basic SATCOM voice services offered by satellite service providers can be found in RTCA Document No. DO-222.

(3) Digital Communications Approval Criteria. Operational approvals are based on criteria in this AC and/or equivalent and, if applicable, training, maintenance, MMEL, or other operationally related criteria formulated by AEG's. If criteria for training or checking are other than as specified in this AC, the criteria may be found in FSB reports applicable to a particular aircraft type. Provisions for dispatch with inoperative equipment are specified by the MMEL for each aircraft type. Maintenance requirements are identified by this AC, unless otherwise described by a MRB report for a specific aircraft type, or in FAA-approved maintenance instructions identified in conjunction with an STC or manufacturer's Service Bulletin.

(4) Digital Communications Approval Methods. FAA Flight Standards provides operational approval of digital communications training programs, checklists, operations manuals, training manuals, maintenance programs, MEL's, and other pertinent documents or document revisions applicable to the particular air carrier. Operators' digital communications programs are usually approved for each specific aircraft type. However, programs common to one or more types may be approved if digital communications programs elements are common to different aircraft types
(e.g., same digital communications systems, procedures).

(5) Digital Communications Approval Procedures.

(a) Approval to use digital communications is provided by an FAA PI. Operators should make early contact with their respective PI's to permit timely FAA response. Usually such contact is initiated at the time preparations are being made for digital communications system selection or purchase.

NOTE: Each operator is assigned three FAA PI's; A POI, a PMI, and a PAI, that are normally located in the CHDO.

(b) Installations, trainings, maintenance programs, MEL's, and other digital communications program elements are reviewed and accepted or approved by the FAA.

(c) Prior to issuance of OpSpecs, or addition of an area, route or procedure to an existing OpSpec, the operator should demonstrate that the aircraft digital communication equipment inter-operates with the digital communication equipment in use at an appropriate ATC facility when communicating by use of the chosen service provider(s). (The results of prior interoperability demonstrations performed as part of a design approval may suffice, if the service provider(s) and air/ground digital communications subnetworks used in those demonstrations were essentially identical to those in the proposed operating approval.) In addition, the operator should show that the digital communication service provider(s) have

demonstrated that the achieved end-to-end performance of the service(s) will meet the RCP for the area or route in question.

(d) Following equipment installation, an interoperability test must be performed by the operator and accepted by an FAA PAI, to demonstrate that the specific combination of digital communication systems elements perform as intended (e.g., FMS ACARS interface, printers).

(6) SATCOM Voice Approval Procedures.

(a) Approval to use satellite voice is provided by an FAA PI. However, approval to use satellite voice shall not diminish any existing requirement to carry other voice systems.

(b) Prior to first issuance of an OpSpec containing a SATCOM voice approval, or the addition of a SATCOM voice approval to an existing OpSpec, the operator should demonstrate that the aircraft equipment can initiate and receive calls to/from a suitable ground location. Such calls should be evaluated only for reasonable clarity and successful completion.

8. PART 121 FLIGHTCREW QUALIFICATION FOR USE OF DIGITAL COMMUNICATIONS.

a. General.

(1) Digital Communications Qualification Issues and Objectives. Air carriers should address the following issues and objectives to ensure appropriate flightcrew digital communications qualification:

(a) Provide necessary flightcrew knowledge of digital communications concepts, systems, and procedures (Digital Communications Academic Training).

(b) Develop necessary flightcrew knowledge and skills to properly respond to digital communications clearances or advisories (Digital Communications Procedure Training).

(c) Assess each pilot's ability to properly use digital communications (Digital Communications Initial Evaluation).

(d) Identify Human Factors issues specific to flightcrew operation and interaction with the communication software, hardware, and operating environment (e.g., head-down time, situational awareness, and loss of party-line information).

(e) Maintain appropriate digital communications knowledge and skills (Digital Communications Recurrent Qualification).

(2) Acceptable Qualification Means. First time digital communications training and qualifications should be addressed during initial, transition, upgrade, recurrent, differences, or stand alone training and qualification programs. The digital communications topics may be

addressed separately or integrated with other curriculum elements. For example, digital communications qualifications may be keyed to specific aircraft during transition, upgrade, or differences courses (e.g., during DC-10 to B747-400 transition), may be addressed in conjunction with general training (e.g., during initial "new hire" indoctrination), or may be addressed in conjunction with recurrent training or checking events (e.g., in conjunction with recurrent proficiency check or proficiency training (PC/PT), or line-oriented flight training (LOFT)). Digital communications qualifications may also be addressed as a separate program (e.g., by completion of a standardized digital communications curriculum at an operator's training center or at designated crew bases).

(3) Credit for Use of Other Programs. Each operator intending to receive credit for digital communications training when the program being proposed is based on previous experience (e.g., Pacific Trials), or when the training is to be conducted by another operator, training center, or manufacturer, must be authorized to receive that part 121 credit from their respective POI. This is necessary even though the digital communications training may already be FAA-approved for the other operator, training center, or manufacturer conducting the training. POI's may permit credit for use of other operator or training center programs if those programs have been approved by FAA and if aircraft, digital communications systems, procedures, and other relevant factors or circumstances are the same or equivalent to those of the operator seeking credit. If a POI is uncertain about the suitability of a proposed program for a particular digital communication system or aircraft type, the POI should consult, through established organizational procedures, with the appropriate division of Flight Standards Service, the NSET, or the assigned AEG as applicable.

b. Digital Communications Academic Training. The following subjects should be addressed in an approved program of digital communications academic training during the initial introduction of a crewmember to digital communication systems. For subsequent programs, only the new, revised, or emphasized items need be addressed.

(1) General Concepts of Digital Communications Operation. Digital communications academic training should cover, in general terms, digital communications systems theory to the extent appropriate to ensure proper operational use. Aircrews should understand basic concepts of digital communications systems operations, nominal performance parameters, digital communications classifications, normal and non-normal use, and limitations.

(2) Level of Capability Provided by Digital Communications and Expected Flightcrew Response. Academic training should explain the normal, expected pilot response to data link messages including acknowledgment, acceptance, rejection, or cancellation of a data link message.

(3) Digital Communications Language, Terms and System Information. Crews should be familiar with data link message sets, abbreviations and conventions used, contractions, terms, message addressing, facility and capability depiction on charts or in manuals, and terminology associated with applications (e.g., CPDLC, FIS, TWDL, ADS, ADS reporting contracts). Crews should be familiar with SATCOM voice procedures, abbreviations and conventions used,

contractions, terms, call addressing, facility and capability depiction on charts or in manuals, and terminology associated with applications (e.g., ATC facility telephone number, access codes, call ID and priority).

(4) ATS Communication, Coordination and Credits for Use of Digital Communications. Crews should be advised of proper flight plan classifications to use and any ATS separation criteria, procedures, or MEL credits that are based on digital communications use. Training should discuss voice communication and coordination with ATC related to or following a data link exceptional event and when to contact ATC by voice.

(5) Digital Communications Equipment Components, Controls, Displays, Audio Alerts, and Annunciations. Academic training should include discussion of digital communications terminology, symbology, operation, and optional controls and display features including any items particular to an air carrier's implementation or uniqueness of its system. Applicable message sets, expected transmission times, failure annunciations, constraints and limitations should be addressed.

(6) Interfaces and Compatibility with other Aircraft Systems. Training should include the management of any applicable digital air/ground communications systems and applications, including; VHF data link, SATCOM data link, SATCOM Voice, HF data link, and Mode S. This training should also address voice integration with other cockpit systems, FMS inputs to data link, and electronic flight instrument system interfaces, including any items particular to an air carrier's implementation or uniqueness of its system.

(7) Aircraft Flight Manual (AFM) Information. AFM provisions should be addressed including information on digital communications modes of operation, normal and non-normal flightcrew operating procedures, response to failure annunciations, and any AFM limitations.

(8) MEL Operating Provisions. Flightcrews, dispatch, and maintenance personnel should be familiar with the MEL requirements.

(9) Flightcrew Response. Appropriate pilot response to data link, SATCOM voice and other such issues.

(10) Data Link Event Reports. The air carrier's data link non-normal event reporting policies for flightcrews.

(11) Data Link Malfunction or Irregularity Reports. Data link malfunction or system irregularity reporting procedures as used by aircrews, if not otherwise addressed by routine maintenance procedures of that operator.

(12) Human Factors. Flightcrew Human Factors are issues specific to the operating environment and operation of the installed communication system.

c. Digital Communications Operational Use Training. In addition to the academic training described in paragraph 8b., appropriate operational use training (e.g., to ensure use of

proper procedures and response to data link advisories) is required. As a minimum, data link use training should expose the pilot to the typical messages expected. Use training must include practice in receiving and interpreting messages, accepting, rejecting or canceling messages, storing and retrieving messages, loading messages into appropriate controls/displays for use (e.g., FMS, FGCS), formulating and sending messages, loading message requests from the FMS (e.g., Flight plan WP's into data link for transmission (if applicable)), and managing the communications systems (establishing and terminating system operation, switching use of RF media (if this is a crew-controllable feature) and re-establishing system operation after loss of network log-on). In addition, training programs should cover the proper use of digital communications controls, procedures, and limitations; correct assessment of displays, aural advisories, and annunciations; timely and correct responses to digital communications failures; and appropriate interaction with ATC following data link messages that are not acceptable, recognition of digital communications systems failures, and data link issues unique to that air carrier, as necessary. Such training may be conducted using digital communications-equipped flight training devices or simulators, or by using suitable CBI. Criteria for programs intending to address proper digital communications use through the use of simulators or training devices are listed in paragraph 8c.(1). Criteria for programs intending to address proper digital communications use through CBI, and not using approved simulators or training devices, are listed in paragraph 8c.(2). Operators may apply provisions of either paragraph 8c.(1) or 8c.(2), or combinations of these provisions to address necessary initial and recurrent digital communications use training, as approved by the FAA for that operator's specific digital communications systems, training devices, and simulators.

(1) Programs Addressing Digital Communications which Use Approved Simulators or Training Devices. Programs based on use of FAA-approved training devices or simulators should realistically depict relevant aspects of digital communications procedures, clearances, and pilot responses. This may be accomplished using one or more of a combination of training methods described in paragraph 8a. Any simulator or training device used should have the characteristics described in paragraph 8m.

(2) Programs Addressing Digital Communications Procedures Through Use of Computer-Based Instruction (CBI). Digital communications programs may be approved which do not require using approved simulators or training devices if the proposed program meets certain criteria as described below. These programs are based on CBI adequately depicting digital communications procedures, clearances, desired pilot responses, and resulting crew interactions with aircraft flight management systems. Such programs may be approved if the program otherwise addresses the issues identified in 8c.(1), and is consistent with the following criteria:

(a) Digital communications systems, displays, and procedures must be consistent with accepted FAA and industry guidelines. There should be no significant adverse training experience related to the particular digital communications system(s) to be used. Differences from or compatibility with other digital communications systems that use different presentation methods, language, abbreviations etc., should be considered in the design to ensure minimum adverse human factors difficulties.

(b) The program must realistically depict digital communications scenarios. The training subject should be made aware of the normal delivery delays to be expected. Scenarios must demonstrate correct indications for messages, display annunciations and aural alerts; and require proper pilot responses.

d. Training Center Approval. Training centers conducting training (e.g., contract training, aircraft manufacturers) may have digital communications elements of those programs approved if:

(1) Provisions of paragraphs 8b. and 8c. are shown to be met, or

(2) Equivalence to a previously approved program can be established. In this instance, circumstances, assumptions, and conditions for the program's use must also be equivalent to those applicable to the previously approved program.

e. Initial Evaluation of Digital Communications Knowledge and Procedures. Individual crewmember digital communications knowledge and procedures should be evaluated prior to digital communications use. Acceptable means of initial assessment include:

(1) Evaluation by an authorized instructor or check airman using a simulator or training device capable of depicting digital communications exchanges;

(2) Evaluation by an authorized instructor or check airman during line operations, training flights, PC/PT events, operating experience (OE), route checks, line checks;

(3) Computer-based testing in which digital communications scenarios and advisories are depicted, which records acceptable pilot performance; or

(4) Other alternate methods acceptable to the Administrator. Alternate methods must demonstrate the equivalent effectiveness of methods (1) through (3).

NOTE: Instructors may be authorized to conduct the required initial digital communications crewmember evaluations if those individuals are digital communications qualified.

f. Digital Communications Recurrent Training. Digital communications recurrent training should be integrated into and/or conducted in conjunction with other established recurrent training programs. Recurrent training for digital communications should include digital communications use while meeting the requirements of paragraph 8c. and should address any significant issues identified by line operating experience, system changes, procedural changes, or unique characteristics.

g. Digital Communications Recurrent Evaluation. Recurrent digital communications checking should be incorporated as necessary, as an element of routine proficiency training or proficiency check programs.

h. Digital Communications Currency (Recency of Experience). Unless otherwise required in an operational specification, once crews have completed initial digital communications training and as long as recurrent training is accomplished in accordance with paragraph 8f., specific digital communications currency requirements are not necessary.

i. Line Checks and Route Checks. When digital communications-equipped aircraft are used during line or route checks, check airmen should routinely incorporate proper digital communications use as a discussion item.

j. Line-Oriented Flight Training (LOFT). LOFT programs using simulators equipped with digital communications should be enhanced by interaction with digital communications. In addition, LOFT programs should consider proper crew use of data link along with other communication methods (SATCOM voice, VHF voice, HF voice, etc.)

k. Crew Resource Management (CRM). CRM programs should address effective teamwork in responding to data link exchanges.

l. Digital Communications Academic Training Methods. Appropriate methods may be suited to each air carrier's program. No special methods related to academic training for digital communications are identified. Typically, a combination of ground instruction, manual information, flightcrew bulletins, and other such means as appropriate to address academic topics specified by paragraph 8b., Digital Communications Academic Training,

m. Characteristics of Simulated Digital Communications Systems for Training (e.g., digital communications in simulators or training devices. Reference paragraph 8c.).

(1) Acceptable Characteristics. Training devices and simulators should have certain characteristics to be effective. This is due to the interactive nature of digital communications, the variety of exchange scenarios possible, the immediate and standardized pilot response required, and the correct display interpretation that is necessary. Thus, simulators or training devices used for digital communications training should have the following characteristics:

(a) The ability to functionally represent digital communications displays, controls, indications, and annunciations.

(b) Ability to depict selected message traffic exchange scenarios including digital communications displays and audio advisories.

(c) Ability to show proper digital communications reaction to depicted scenarios and advisories, crew or ATC response errors, etc.

(d) Ability to interactively respond to pilot inputs regarding digital communications advisories, including responses to failures or non normal situations.

(2) Simulator and Digital Communications System Fidelity. For a particular digital communication system, training may be accomplished in simulators or training devices which represent the specific aircraft, or an aircraft that has similar characteristics. For the purposes of digital communications training, simulators or training devices may use simplified algorithms or abbreviated message set capability. Digital communications displays do not have to be identical, but must be functionally equivalent to the air carrier operator's specific aircraft in use.

(3) Training Device or Simulator Approval. Training devices or simulators meeting FAA criteria are qualified by the NSET and approved for use by the POI. Any one or combination of the following devices or simulators which meet characteristics of paragraph 8m.(1) above, Acceptable Characteristics, may be used:

(a) Level A through D simulators,

(b) Level 2 through 7 flight training devices, or

(c) Dedicated digital communications training devices acceptable to the FAA (including those devices described in FAA Order 8400.10, Air Transportation Operations Inspector's Handbook, volume 3, paragraph 443, "Aircraft Systems Integration Training" which are shown to be suitable for digital communications training).

NOTE: Training device and simulator levels are defined by AC 120-40B, Airplane Simulator Qualification; AC 120-54 Advanced Qualification Program; and FAA Order 8400.10.

n. Crew Qualification for SATCOM Voice.

(1) SATCOM Voice Academic Training. The following subjects should be addressed in an approved program of SATCOM voice academic training during the initial introduction of a crewmember to SATCOM voice. For subsequent programs, only the new, revised, or emphasized items need be addressed, as appropriate.

(a) General Concepts of SATCOM Voice Operation. SATCOM voice academic training should cover, in general terms, SATCOM voice system theory to the extent appropriate as to ensure proper operational use. Aircrews should understand basic concepts of SATCOM voice operation, nominal performance parameters, institutional policies on use of SATCOM voice calls for direct communication with ATC, and limitations.

(b) Level of Capability Provided by SATCOM Voice and Expected Flightcrew Response. Academic training should explain the normal, expected pilot response to arriving SATCOM voice calls including call answer, hold, and termination procedures.

(c) SATCOM Voice Terminology and System Information. Crews should be familiar with operational terminology, telephone numbering plans, ATC telephone dialing codes published in flight information, and the availability of published NOTAM’s on SATCOM voice services available at Oceanic ATC Centers.

(d) SATCOM Voice Equipment Components, Controls, Displays, Audio Alerts, and Annunciations. Academic training should include discussion of SATCOM voice equipment operation including MCDU pages, audio panel functions, SELCAL utilization, and priority of flight deck calls over passenger communication.

(2) SATCOM Voice Operational Use Training. In addition to the academic training described in paragraph 8n.(1), appropriate operational use training, to assure use of proper procedures is required. As a minimum, SATCOM voice operational use training should expose the pilot to call origination and acceptance procedures, include the recognition of failed call origination attempts, and the actions required in order to place a SATCOM voice call on hold.

9. OTHER OPERATIONAL ISSUES.

a. Manuals and Other Publications. Airplane flight, operating, maintenance, general policy, or other manuals, publications, or written materials (e.g., operating bulletins) that may relate to digital communications use must be appropriately amended to describe digital communications equipment, procedures, and operational policies according to the appropriate regulations.

b. MMEL/MEL. Operators formulate necessary digital communications revisions to their MEL(s) for each particular fleet (e.g., B727, DC10). MEL revisions must be consistent with the FAA's MMEL established for each aircraft type. A summary of the process for addressing the necessary changes to MEL items as well as examples of MMEL and acceptable MEL provisions for digital communications are provided in Appendix 2.

c. Aircraft with Digital Communications System Differences. Operators having aircraft with digital communications systems differences in displays, controls, or procedures, or involved with interchange operations, must account for those digital communications systems differences. This is accomplished as part of an approved differences training program in accordance with part 121, or as otherwise specified in applicable FAA FSB reports concerning crew qualification pertaining to a particular airplane type.

d. Issues Unique to a Particular Operator. Operators should address any digital communications issues that may be unique to their particular route environment, aircraft, procedures, or digital communications displays and control features. Examples include the following:

(1) Examples of "Route Environment" Issues. Operators should describe any peculiarities associated with a particular route that may involve either end-user application issues or communications performance issues, for example:

(a) On NAT routes, when under control of Gander, it is necessary for data link clearance message verification to include the message serial number in the readback.

(b) A particular route may be subject to propagation disturbances (e.g., with HF radio, HF Data Link or SATCOM communications) at particular locations, time of day, season, or sun-spot cycles.

NOTE: Current and forecast availability values for the air-to-ground radio-frequency communications paths and/or other components, that are time and location-sensitive, may be offered by communication service provider(s). Application of such an Actual Communications Performance (ACP) technique may permit the operator to determine whether the RCP requirement is met for each particular flight. See Appendix 5, paragraph 4.

(2) Example of a "Procedural" Issue. Operators should describe any data link precautions that may be appropriate when operating in states where digital communications policies are uncertain. As an example, certain modes of direct controller-pilot digital communication, in the form of either data link and/or SATCOM voice, may not be supported in certain states. In those cases, carriers should conform to the laws and regulations that govern the airspace being used and use only authorized communications equipment and methods. This guidance should be reflected in company flight operations manuals.

(3) Example of a "Unique Digital Communications System" Issue. Operators should describe any differences in particular digital communications systems, or their versions, that may have operational impact. For example, Boeing FMS “Load 11” software requires a workaround solution for incorporating the aircraft tail number in data link messages, whereas “Load 12” does not.

10. MAINTENANCE.

a. General. Maintenance procedures for digital communications are approved or accepted as part of an operator's initial maintenance manual approval or as a revision to that manual. Digital communications maintenance procedures must be consistent with the digital communications systems manufacturer's maintenance procedures and/or aircraft manufacturer's maintenance procedures for digital communications.

b. Maintenance Training. Operators must provide adequate digital communication maintenance training in accordance with the appropriate regulation to ensure that their maintenance personnel or contract maintenance personnel at facilities not staffed by the operator are able to properly implement digital communications-related maintenance programs. This includes, but is not limited to, addressing installation, modification, correction of reported system discrepancies, use of test equipment, procedures, MEL relief, and "return-to-service" authorizations. The training procedures should address testing digital communications on the ground in such a way that correctly evaluates digital communications functions while not introducing hazards with respect to simulated message traffic with an air traffic facility.

c. Digital Communications System Software Updates. Operators should assure that appropriate digital communication software updates are incorporated when necessary and that both air and ground system are able to identify and properly respond to the installed level of digital communication capability.

d. Digital Communications "Return to Service" Policies. Digital communications "return to service" policies must be established to ensure proper digital communications functions when

an aircraft is returned to service after a digital communication failure or maintenance action. An operator should not release an aircraft to service where digital communication functionality is required unless appropriate verification of proper function has been re-established.

11. DIGITAL COMMUNICATIONS OPERATIONAL USE.

a. General. Operationally, those skills addressed and the guidance provided in the digital communications training paragraph 8 will be followed and implemented by each operator electing to use digital communications.

b. Pilot Responsibilities. Digital communications are intended to serve as either a primary or supplementary communications means as designated for the operations being conducted. For digital communications to work as designed, prompt and correct initiation response to data link advisories is important. Flightcrews are expected to respond to digital communications in accordance with the following guidelines:

(1) Prompt initiation of messages where needed.

(2) Prompt response to messages where appropriate.

(3) Appropriate crew coordination so that each crewmember receives pertinent information needed.

(4) Appropriate retention of messages (archive) requiring later action (printer copies of oceanic clearances etc.).

(5) Appropriate resolution of message uncertainty.

(6) Appropriate use of data link and voice, respectively, where circumstances dictate (e.g., voice for backup or clarification of non-normal situations).

(7) If an ATC data link clearance contradicts a voice clearance, comply with the voice clearance.

c. Digital Communications Good Operating Practices. The following digital communications "good operating practices" have been identified:

(1) To preclude unnecessary communication and possible interference with ground facilities, digital communications should be used only in conjunction with facilities specified for the route or procedure to be flown (e.g., digital communications with other than designated ground facilities should be accomplished only as necessary to support flight plan or flight operations requirements).

(2) Free text data link messages should use standard aeronautical terminology, accepted abbreviations, and (be written in English).

(3) Verify digital communications functions prior to departure.

d. Operator Responsibilities. Operators have the following general responsibilities regarding digital communications:

(1) Verify digital communications functionality for each environment to be used and when new or modified components or software are introduced.

(2) Assure follow-up and evaluation of exceptional data link events, and

(3) Periodically assess digital communications training, checking, and maintenance programs to ensure their correctness, pertinence, timeliness, and effectiveness.

e. ATC Responsibilities.

(1) Ensure that controllers do not knowingly issue data link instructions that are contrary to voice instructions when a data link is being used.

(2) Be aware of pertinent digital communications program changes.

(3) Train ATC specialists about data link, expected flightcrew responses to data link advisories, and permit familiarization flights for specialists on data link equipped aircraft to the extent possible.

(4) When requested by the flightcrew, provide clarification or confirmation of data link messages and assist in returning to the assigned clearance, if appropriate. Issue additional clearance instructions when the situation so requires.

(5) Advise pertinent FAA offices via digital communications questionnaires about airspace or airports where digital communications problems occur. This facilitates initiation of corrective actions related to digital communications enhancements, procedures, and airspace adjustments.

(6) Advise FAA if aware of other hazardous conditions, situations, or events which may be related to digital communications.

12. DATA LINK EVENT REPORTING.

a. General. Operators and manufacturers are encouraged to develop procedures to ensure effective identification, tracking, and follow up of exceptional data link-related events, as appropriate. Such procedures should focus on providing useful information to:

(1) Properly assess the importance of data link events,

(2) Follow up on information related to specific data link events as necessary, and

(3) Keep the industry and FAA informed on the performance of data links in NAS and international operations.

b. Pilot Reports.

(1) "Data Link-Specific" Reports. Pilots should make the following reports for unusual data link events, as necessary:

(a) Upon query from ATC, or after an inadvertent deviation from an ATC clearance, make radio communications as appropriate to report the event. Refer to the Airman's Information Manual, Section 4, ATC Clearances, for guidance regarding recommended phraseology, and Appendix 5 of this AC for acronyms and abbreviations.

(b) Reports, as specified by the operator, concerning data link anomalies, procedural difficulties, or system failures typically are made by pilots through one or more of the following methods:

- Pilot/Observer Questionnaire,
- Logbook entry, ACARS, etc., or
- Other record used by that operator (e.g., "Captain's Report"). An example of a typical reporting form for data link event information is shown in Appendix 1.

(2) Other Reports Incidental to Data Link.

(a) NMAC Reports. Flightcrews should continue to submit NMAC reports in accordance with existing policies and procedures. (Crews should be aware that there is no requirement to submit an NMAC report solely due to a data link event).

(b) Aviation Safety Reporting System (ASRS) Reports. ASRS reports may be filed at the discretion of the flightcrew.

(c) Operator/Maintenance Department Reports. Operator maintenance department personnel should make data link-related reports as necessary. Submit reports of frequent or systematic data link problems that may relate to system performance, manufacturers, and/or data link vendors to the PAI or PMI, as appropriate.

(d) FAA ATC. Report the following:

- Data link events to FSDO’s as necessary
- Any exceptional data link-related events regarding NAS performance to the Air Traffic Procedures Division, ATP-100

(e) Data Link Manufacturer Reports. Data link avionics manufacturers report problems found with specific data link systems in accordance with established service difficulty report (SDR) procedures. Generic problems, such as those that may relate to the definition of ARINC 622 or 745 characteristics or of documents listed in paragraph 4(c) should be reported to the Aircraft Engineering Division, AIR-100.

13. FOREIGN AIR CARRIERS.

a. General. Digital communications may be used by foreign air carriers when operating in U.S. airspace. Foreign air carriers are not required to install and use digital communications for any aircraft or operations even though separation services may be provided by a U.S. ATC facility (e.g., in oceanic airspace), unless separation standards or a desired flight plan classification are based on its use.

b. Digital Communications Approval for Foreign Air Carriers. FAA does not approve digital communications installations, training programs, MEL's, or maintenance programs for foreign operators operating non-U.S. registered aircraft. Such authorizations are addressed as specified by the state of the operator or by the International Civil Aviation Organization (ICAO). However, since compatibility of digital communications and NAS facilities within U.S. airspace is essential, part 129 operations guidelines for digital communications are issued by FAA to all foreign air carriers operating within U.S. airspace. Compliance with these digital communications provisions ensures both digital communication system and procedural compatibility. The issuance of operations specifications or an amendment to existing OpSpecs for digital communications must take place prior to a foreign air carrier operating a digital communication-equipped aircraft in U.S. airspace, or with U.S. facilities. Standard provisions for foreign air carriers for digital communications are shown in Appendix 3.

c. Application and Approval. Foreign air carriers should contact their FAA POI to obtain application information for part 129 digital communications operations specifications. When a foreign air carrier submits the necessary information to the respective PI, showing that its aircraft comply, the PI approves those operations specifications or an amendment. Standard operations specifications provisions regarding digital communications for foreign air carriers are shown in Appendix 3. Although not mandatory, foreign operator compliance with the provisions of this AC, or equivalent provisions specified by the state of the operator or specified by ICAO, are expected.

/s/
L. Nicholas Lacey
Director, Flight Standards Service

APPENDIX 1.
SAMPLE DATA LINK EVENT REPORTING INFORMATION

Date_____ Time_____

Operator/Flight #_____ Origination_____ Destination_____

Submitted to: ATC Inquiry_____ Other_____

Phase of Flight_____ Position_____ Altitude_____

(Optional for Aircrew:)
Name_____ Phone (W)_____ Phone (H)_____

Describe Event:

APPENDIX 2.
DIGITAL COMMUNICATIONS MINIMUM REQUIREMENT LIST (MEL) AND MASTER MINIMUM EQUIPMENT LIST (MMEL) PROVISIONS

1. EXAMPLE OF A MINIMUM REQUIREMENT LIST (MEL). Each operator intending to have authority to dispatch an aircraft with a digital communication system or component temporarily inoperative must do so in accordance with provisions of a MEL. MEL's are approved for each operator and type aircraft, within provisions of the FAA MMEL for that type. When proposed, MEL provisions are consistent with the FAA MMEL, POI's may approve the MEL. If a less restrictive MEL or different MEL provisions are requested, a proposal for consideration of an FAA MMEL change must be forwarded to the AEG assigned for that aircraft type. Enhanced features (those above and beyond the basic digital communication system) may be inoperative, provided that the inoperative features do not degrade the system; for example, data link printers.

Equipment		**Condition**
Data Link system	C-0	*(M) May be inoperative provided the system is deactivated and secured and that operational credit is not predicated on its use.
Dual data link or data link controls or displays	C-21	*(0) May be inoperative on the flying pilot side provided that: (a) Appropriate data link elements and functions are operative on the non-flying pilot side, and (b) Display data link indications are visible to the flying pilot. (0) May be in-operative on the non-flying pilot side, provided that: (a) All voice communications are operative and that voice procedures are approved for the route or procedures to be flown, and (b) All voice command communications audio functions are operative, and voice procedures may be used for the route or procedures to be flown.
Data Link Printer	C-0	(0) May be inoperative provided all other data link display and control functions are operative and all elements of each data link transmission can be retrieved, displayed and reviewed by the flight crew or may be inoperative if relevant operations or functions are not predicated on data link use (e.g., Print Control function not authorized if the printer is inoperative).

APPENDIX 2. (continued)

2. EXAMPLE OF A DATA LINK MASTER MINIMUM EQUIPMENT LIST (MMEL) PROVISION.

Boeing 747-400

23 COMMUNICATIONS				
-XX-1 Digital Data Link Communications Systems	D	-	-	Any in excess of those required by Regulation may be inoperative.
-XX-2 Digital Voice Communications Systems	D	-	-	Any in excess of those required by Regulation may be inoperative.

NOTE. The provisos and repair category intervals are intended to grant the operator sufficient relief during the initial stages of the data link implementation. This is intended to promote the installation process, as well as support the use of a partial system. Both equipment reliability and operational experience will dictate, if any, revision to this MMEL relief should be considered after the installation phase is completed.

APPENDIX 3.
PART 129 PROVISIONS FOR USE OF DATA LINK IN U.S. AIRSPACE

1. An appropriate data link must be installed and operated on suitable frequencies specified by ATC during flight in U.S. airspace if procedures are predicated on its use. A unique and specific address, the ICAO 24-bit aircraft identification, must be assigned to the airplane and the data link must recognize this address. When properly set, the unique address, may not be altered, set to a duplicated address, or set to an address that potentially interferes with ATC or data link safety functions.

2. A data link capable of coordinating with air traffic facilities using RTCA DO-219 (current version) or other equivalent standards must be installed. Except as provided for by MEL provisions acceptable to the State of the operator or, the data link system must be operated in an appropriate data link mode during flight in U.S. airspace using data link.

3. Training and procedures for use of data link as specified by ICAO, this AC, or other equivalent criteria acceptable to FAA, must be used when operating in U.S. airspace.

4. Unsafe conditions or performance related to data link operations which potentially could affect continued safe operations in the U.S. NAS (a data link event) must be reported to the FAA POI within 10 days of the time that such a hazard is identified.

APPENDIX 4.
ACRONYMS AND ABBREVIATIONS

AC	Advisory Circular
ACARS	Aircraft Reporting and Communications System
ACO	Aircraft Certification Office
ACP	Actual Communications Performance
ADS	Automatic Dependent Surveillance
AEG	Aircraft Evaluation Group
AFM	Airplane Flight Manual
AFS	Flight Standards Service (FAA)
AGL	Above Ground Level
AIR	Aircraft Certification Service (FAA)
ARD	Research and Development Service (FAA)
AMSS	Aeronautical Mobile Satellite Service (sometimes (AMS(R)S specifically for safety services)
AOC	Aeronautical Operational Control
ASRS	Aviation Safety Reporting System
ATC	Air Traffic Control
ATCRBS	ATC Radar Beacon System
ATIS	Automated Terminal Information Service
ATP	Air Traffic Procedures Division (FAA)
ATS	Air Traffic Service
ATM	Air Traffic Management
CAA	Civil Aviation Authority
CBI	Computer-Based Instruction
CHDO	Certificate-Holding District Office
CNS	Communications/Navigation/Surveillance
CFR	Codified Federal Regulations
CPDLC	Controller-Pilot Data Link Communication
D-ATIS	Digital Automated Terminal Information System
DC	Digital Communications
DCPC	Direct Controller-Pilot Communication (voice or data)
DL	Data Link
EICAS	Engine Indicating and Crew Alerting System
EFIS	Electronic Flight Instrument System
FAA	Federal Aviation Administration
FANS	Future Air Navigation System
FMS	Flight Management System
FOEB	Flight Operation Evaluation Board
FSB	Flight Standards Board
FSDO	Flight Standards District Office
HF	High Frequency (radio)
ICAO	International Civil Aviation Organization
ICP	Installed Communications Performance

ISA	International Standard Atmosphere
LOFT	Line-Oriented Flight Training
MASPS	Minimum Aviation System Performance Standards
MEL	Minimum Equipment List
MMEL	Master Minimum Equipment List
MRB	Maintenance Review Board
MSL	Mean Sea Level
NAS	National Airspace System
NMAC	Near Mid-Air Collision
NSET	National Simulator Evaluation Team
NTSB	National Transportation Safety Board
OE	Operating Experience
PAI	Principal Avionics Inspector
PC	Proficiency Check
PDC	Pre-Departure Clearance
PI	Principal Inspector
PMI	Principal Maintenance Inspector
POI	Principal Operations Inspector
PT	Proficiency Training
RCP	Required Communications Performance
SATCOM	Satellite Communications
STC	Supplemental Type Certificate
TC	Type Certificate
TSO	Technical Standard Order
VHF	Very High Frequency (radio)

APPENDIX 5.
REQUIRED COMMUNICATIONS PERFORMANCE (RCP) CONCEPT

1. The Required Communications Performance (RCP) Concept. The concept of RCP relates to the communications component of the CNS/ATM framework, and complements Required Navigation Performance (RNP) and Required Surveillance Performance (RSP). In general, the requirements for operation in a defined airspace, or performance of a defined procedure, include elements of communication, navigation, and surveillance (CNS) functionality and performance, as well as air traffic management (ATM) functionality and performance. The schema for the "goodness" of a CNS system is generally accepted as comprising technical performance, integrity and availability.

2. Required Communications Performance.

a. Required Communications Performance is a statement of the end-through-end communication performance necessary for flight within a defined airspace, or performance of a discretely defined operation or procedure. An RCP is determined by cognizant authorities in consideration of air traffic operations, target levels of safety, separation assurance, flight standards and functional hazard analysis associated with the airspace, operation or procedure. Thus, RCP is independent of the technology, or combination of technologies, that may be utilized for communications.

b. A three-dimensional schema for describing the "goodness" of a CNS system - Technical Performance, Availability and Integrity - is gaining widespread acceptance. The most important technical performance parameter is considered to be the delay experienced by information transfer between end users of the system. Integrity relates to the freedom of errors in the information transfer process. Availability relates to the proportion of time that communications systems provides information transfer service to the quantitative levels required by RCP parameters.

c. Work is underway in RTCA in the development of a Minimum Aviation System Performance Standards (MASPS) defining the terminology and parameters of the RCP concept. The draft definitions of the parameters are as follows:

(1) Delay is a measure of the time required for an information element to transit between two identifiable points.

(2) Integrity is expressed as the probability of an undetected system-induced failure of message transmission (i.e., undetected message error, wrong address, lost message transmission).

(3) Availability is the ratio of actual operating time to specified operating time.

3. Installed Communications Performance (ICP).

a. End-through-end ICP is a statement of the nominal performance of a given end-through-end communication string comprised of: the aircraft end system, avionics, aircraft radio(s), and RF path(s); ground station(s), and ground network(s); and the service arrangements and levels that have been arranged for with air/ground service providers, and the ground end system(s). ICP is expressed in the

same terms and with the same parameters as RCP, so that ICP can be compared directly with RCP. Further, ICP can be allocated to each of the discrete elements of the end-through-end communication string; or, conversely, end-through-end ICP can be determined by appropriate combination of the ICP_X of each element.

b. Demonstration of end-through-end ICP is part of the operational approval for a specific RCP environment or operation. ICP is inherently tied to one or more specific technologies and is the term used to describe the performance of a particular end-through-end communications paths as certified by the cognizant authority. ICP is associated with a given aircraft because it strongly is influenced by the aircraft's equipage and the communications support arrangements that have been made for it.

c. The ICP of a given aircraft may be used to evaluate whether or not that aircraft meets a specific RCP for a given operation or airspace; hence, the RCP level required for dispatch or initiation of an operation. Consequently, ICP provides a tool for evaluating the benefits of varying levels of aircraft communications equipage and service arrangements.

4. Actual Communications Performance (ACP). Actual Communications Performance is a statement of the *dynamic* end-through-end communications capabilities of the same end-through-end communications strings as for ICP. ACP is expressed in the same terms and parameters as RCP and ICP, but at a given instant may differ from the ICP of a particular chain, due for example, to equipment malfunctions or changes in propagation conditions. ACP can be determined periodically by monitoring the end-through-end chain, or by monitoring the current condition of the chain's elements. The operational application of ACP is not yet determined.